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ABSTRACT

This study determined the quantitative and qualitative portrayal of females and minorities in the illustrations of seven contemporary elementary science textbook series. An evaluation instrument was devised to determine the current status of the targeted groups. Illustrations were evaluated on the basis of minority versus nonminority and male versus female representation. The activity and assumed role of the individuals were also tabulated. A total of 5,965 human illustrations were evaluated. Results reveal that the group "female children" is represented with greater frequency than are other child groups. Minority children are represented less often than nonminority children, and female and and minority adults are depicted less often than nonminority male adults. Although the textbooks evaluated in this study display science positively for most societal groups, minorities are underrepresentated and illustrated in a limited number of career roles. Implications and suggestions for teachers, supervisors, and teacher educators are provided. For example, it is suggested that adult females and minorities be depicted with greater frequency in a variety of occupational and nonoccupational roles. (Author/JN)

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The Portrayal of Minorities and Women in Selected Elementary Science Series

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The Portrayal of Minorities and Women
in Selected Elementary Science Series

Abstract

The purpose of this study was to determine the quantitative and qualitative portrayal of females and minorities in the illustrations of seven contemporary elementary science textbook series. An evaluation instrument was devised to determine the current status of the targeted groups. Illustrations were evaluated on the basis of minority/nonminority and male/ female representation. The activity and assumed role of the individuals were also tabulated. A total of 5,965 human illustrations were evaluated. The results reveal that the group female children is represented with greater frequency than are other child groups. Minority children are represented less often than nonminority children and female and minority adults are depicted less often than nonminority male adults. The textbooks evaluated in this study display science positively for most societal groups, however minorities are underrepresented and illustrated in a limited number of career roles. Implications and suggestions for teachers, supervisors, and teacher educators are provided.

Introduction

Textbooks are an integral part of instruction. Only occasionally do classroom deliberations extend beyond the boundaries established by the textbook authors. Textbooks, irrespective of the subject area, are the source of information in the secondary school. Readings, assignments, discussions, and test-related items all revolve about the content of the text. In an extensive study of teaching practices in the secondary science classroom, Stake and Easely (1978) found that students rely heavily on the textbook. Similar findings indicate that instruction in science in the elementary school is also centered on textbooks or other adopted curricular materials (Stake and Easely, 1978; Harms and Yager, 1981). While some reading of the prose is necessary in primary grades, the illustrations serve to guide the teacher and student in the process of learning science concepts and performing science related activities.

In the elementary classroom, the science textbook serves three major purposes. First, the textbook is used as an instructional tool. Children read about science, discuss science related questions, and use the text as a guide for laboratory or investigative activities. Second, learners become acquainted with the relationship between science and society; by depicting children and adults in varied science activities, roles, and settings texts help young learners develop positive self-concepts and identify potential careers in science. Third, the text provides students with a glimpse of an ideal society as perceived by publishers. Since this ideal society may include and exclude particular societal groups, students may also hypothesize the importance of such groups with respect to science and science-related fields.

Our major purpose in this investigation was to examine for the portrayal of society by publishers as they provide young learners with a fundamental grasp of the sciences. We believe science textbook publishers should depict society as it was, is, and should be when describing science concepts and generalizations. This approach which we call social action science education, serves two purposes: (1)provides young learners with illustrations of individuals of all walks of life involved in science, and (2)provides minority and female learners--representatives of groups underrepresented in the sciences--with examples of the targeted groups actively involved in science activities and in science professions.

It seems to us that most contemporary publishers now practice some form of social action science education. For example, most of the science content presented to young learners lends itself to this three-pronged approach. Typical themes introduced in a elementary series include the following: "light", "magnets", "electricity", "exploring the universe", "energy resources", "oceans of the earth", "plants", and "interactions of matter". These are not "people oriented" topics but publishers give them a human dimension by depicting people using forms of energy, harvesting food, exploring new life forms and the like. Where appropriate, publishers also portray an ideal society by including illustrations of people of all walks of life involved in some form of science activity. Lastly, because of society's insistence that all children be provided with a quality education, publishers include illustrations of individuals (e.g., minorities, women, handicapped persons) who have been underrepresented in textbooks. The rationale for this impetus in that students who are members of these underrepresented groups will view science positively and aspire to science professions.

The key to an effective social action science program is balance, a

portrayal that avoids a misrepresentation of societal groups. To ensure a balanced representation publishers should follow these simple guidelines: (1)select illustrations for a total series rather than individual texts, (2)be aware that specific science topics may enhance a particular societal portrayal, (3)avoid distortions and stereotypes. It seems to us that publishers overlook this key element when selecting illustrations for science series.

Portraying society as it was, is, and should be is not without its critics. Some argue that it is contradictory and others postulate that it is a new form of censorship. We do not feel these two criticisms are valid. As we suggest above, by emphasizing a balanced and comprehensive portrayal of groups contradiction and censorship are avoided. Second, social action science provides children with a historical, contemporary, and ideal perspective of science and society; the attempt is not to favor one thrust over another but to present all three. Also, although the focus of attention is the representation of societal groups in illustrations, social action science does not deter from an adequate treatment of science concepts and generalizations which are more about "things" then about human interactions. Lastly, this approach seems to more effectively address many of the objectives of science education and the more global goals of education.

Review of Literature

The literature seems to suggest that science educators have been somewhat interested in the portrayal of societal groups in textbooks. Previous content analyses have been concerned with the representation of females and males in the on-going prose and illustrations. Analyses of

illustrations have concentrated on the following areas: (1)the frequency and proportion of male and female adults in the illustrations; (2)the portrayal of children and adults according to activity and role association; (3)the number of males and females portrayed in adult scientific roles; and (4)the passive or active state of individuals illustrated. Heikkinen (1978) evaluated and compared 17 contemporary secondary chemistry texts with similar dated texts to determine the portrayal of females and to identify the career status of male and female representation. The texts were evaluated according to the number of adolescents and adults in the illustrations with respect to their role association and active or passive nature. The results clearly indicated an inordinate amount of sex bias and stereotyping; males were shown in greater frequency, in more active situations and, in a greater variety of roles. Similarly, Taylor (1979) evaluated three secondary level physics texts for sexist portrayals by examining the illustrations and prose for the representation of males and females with respect to frequency and type of activity. Taylor concluded that physics is depicted as a masculine area of study with little or no opportunity for female involvement. Arnold (1975) evaluated a number of earth science texts for the portrayal of females and males. She found females omitted from illustrations, ignored in discussions of the history of science, and not alluded to in earth science careers.

An evaluation of elementary science texts used by the Pittsburgh Public Schools indicated that males (e.g., boys, adolescent males, and men) are represented in illustrations with greater frequency than are females (Scardina, 1972). The frequency of females in these texts decreased as the grade level increased. Few, if any, illustrations depicted females in

science or science-related roles. In a more contemporary analysis of texts across various areas of study, science textbooks depicted males with much greater frequency than females. Males were more often shown actively involved in experiments, conducting demonstrations, and playing other major roles in the area of science than were females, (Weitzman and Rizzo, 1974).

More recently, the Manitoba Department of Education (1980) evaluated six contemporary elementary science textbook series for the portrayal of the sexes by tabulating frequency of occurrence of males and females in illustrations with respect to role assignment and activity involvement. The results indicated sex bias in four of the series. In the textbooks males were overrepresented, involved in more active roles, and presented more often in a variety of occupational roles than were females. Similarly, 80 science textbooks used in elementary and secondary schools of New Zealand were evaluated for male and female representation (New Zealand Department of Education, 1980). Data were recorded for number and types of roles and activities assigned to each sex; frequency of occurrence of each sex in an illustration, reference to famous males and females and, sexist language. Some of the findings included: (1)over 85% of the occupations illustrated were assigned to males; (2)males were more frequently illustrated than females in primary and elementary science texts; (3)famous males were represented 19 times more often than females.

Gallagher (1980) conducted an extensive study of the elementary science textbooks adopted for use by the state of California to determine the portrayal of females. A total of 30 books were evaluated for representation in the prose and illustrations. Books adopted in 1970-71 were compared with those adopted in 1980-81. While female representation in the illustrations of these books increased during the ten year span,

females were represented less often than males.

Content analyses for the representation of minorities in science texts were almost nonexistent. The authors found only one recent study that reviewed science texts for ethnic representation (Manitoba Department of Education, 1980). Subjective analysis of these texts revealed that five of the six series were relatively free of ethnic bias. According to the researchers, children and adults of various ethnic backgrounds were adequately depicted in the illustrations.

Other investigations have examined the relationship between student self-perceptions, peer and societal role expectations, and the science textbook. According to Schenck (1976), by the time a young woman graduates from high school she will have received so many cues about gender appropriate behavior from books and other sources that she may be psychologically committed to culturally acceptable roles. Some investigators contend that the language in the captions of the illustration also has an influence on a child's perception of gender appropriate behavior. After a group of third graders was shown a number of illustrations and the masculine generic terms in the captions accompanying each illustration, some of the children did not consider females when presented with masculine generic terms and illustrations depicting individuals in various occupations (Harrison and Passero, 1975).

Purpose

The purpose of this study was to determine whether males, females, minorities, and nonminorities are quantitatively and qualitatively represented in the illustrations of contemporary elementary science series (1-6)in a manner that is reflective of society as it was, is, and as it

should be. To achieve this purpose the investigators examined illustrations to determine whether: (1)individuals of all ages regardless of sex or race are included, (2)individuals of all ages regardless of sex or race are depicted as active participants in science activities, (3)adult minority an nonminoirty males and females are depicted in a variety of career roles related to science.

The following hypotheses were developed:

(1)If elementary science textbooks display science positively for all societal groups, then the illustrations will depict a variety of individuals as active participants in science activities regardless of sex, race, or age.

(2)If all students are to favorably associate themselves as participants of science activities or roles, then the science textbook illustrations will include peers in a variety of science activities and settings, regardless of sex or race.

(3)If career fields in science are to be presented to females and minorities, then the illustrations of elementary science textbooks will depict females and minority group members in a variety of occupational roles related to science.

Textbook Selection

The elementary science textbooks examined in this study are not necessarily representative of all series employed in classrooms throughout the United States. However, to ensure that a number of publishing houses were represented, the investigators used the following strategies to select texts: (1)Requests for series were made to publishing houses marketing K-6 science series in recent issues of Science and Children, a journal of the National Science Teachers Association for elementary schools. (2)Requests

for series were made to publishers exhibiting at the 1983 Conference for the Advancement of Science Teaching in San Antonio, Texas. (3)Current series located in the Science Teaching Laboratory in the Department of Educational Curriculum and Instruction, Texas A&M University were also identified for possible use in this examination. The investigators selected the seven most contemporary series available.

The following series were examined:

(1)Blecha, Milo K., et.al. (1982). The New Exploring Science (1-6). River Forest, Illinois: Laidlaw Brothers.

(2)Cohen, Michael R., et.al. (1984). Science (1-6). Glenview, Illinois: Scott, Foresman, and Company.

(3)Holmes, Neal J., et.al. (1983).Gateways to Science (1-6). New York: McGraw-Hill Book Company.

(4)Barry, Eileen, et.al. (1981). Science Work-A-Text Program (1-6). Cleveland Ohio: Modern Curriculum Press.

(5)Barufaldi, James P., et.al. (1984). Heath Science (1-6) Lexington Massachusetts: D.C. Heath and Company.

(6)Mallinson, Geogre G., et.al.(1984). Silver Burdett Science (1-6). Morristown, New Jersey: Silver Burdett Company.

(7)Sund, Robert B., et.al. (1983). Accent on Science (1-6). Cleveland, Ohio: Charles E. Merrill Publishing Company.

Methodology and Procedures

Suggestions as to possible criteria for evaluating secondary science and health texts are available (Heikkinen, 1978; Holcomb, 1981). Gallagher (1980) also provides definitive guidelines for quantitative and qualitative analyses for sexist portrayals in elementary science texts. However, to evaluate the illustrations for portrayal of ethnic groups and females and collect data respective of the formulated hypotheses it was necessary to develop a new instrument. The subsequent instrument developed evaluates elementary science textbook illustrations for sex, race, action, and role

association. No attempt was made to incorporate an instrument that would evaluate the on-going prose of the textbooks.

The investigators initially reviewed dated elementary science textbooks not included in this study to develop the instrument. Illustrations, photographs, and sketches depicting individuals were critically reviewed and discussed. Definitions of active and passive were developed after reviewing various descriptions of science activities (Trowbridge, et.al., 1981; Lunnetta and Tamir, 1979). The investigators then developed and abided by the following definitions when coding individuals by group, race, and sex.

active - an individual(s) in the illustration performing an activity; an individual interacting either by physical manipulation, active observation, or mental speculation; for example, an individual observing with the intent of obtaining information; an individual interacting with something in the environment by physical contact, such as measuring, handling an object, performing an experiment, or being acted upon by an object or another individiual; an individual displaying an object or experiencing a phenomenon; captions and other clues in the ongoing prose were used to categorize an individual as active

activity - one or two word descriptors identifying the actions of an individual displayed in the illustrations.

aerial illustration - a photograph or diagram, usually with large spatial qualities, showing sizeable groups of individuals performing similar activities e.g., individuals massed together in a specific geographic location

animated figures - human forms in animation; tabulated in category 1, 2, or 4 (see definition for category) according to established criteria

appendage only illustations - a diagram that displays only an appendage of the human body e.g., hand, arm, leg, foot; extensions of an appendage e.g., fingers, toes; or close-up photography of parts of the body e.g., nose, ear, or mouth, and presented in a manner that hinders the identification of the individual by gender; appendages with clear indication of race were noted as such; appendages shaded in the illustration whereby race could not be clearly identified were noted as race unidentified

category - a specific type of illustration delimited for coding; displays specific characteristics

category 1 - child illustration, an illustration containing young children or adolescents

category 2 - adult illustration, an illustration containing adults

category 3 - aerial illustration

category 4 - appendage only illustration

child/adult combined in illustration - illustration includes child and adult; for tabulation, two entries were made, category 1 was coded first, then category 2 on a separate tabulation line

full body/appendage combined in single illustration - some illustrations depict an individual who can be categorized as 1 and 2 in addition, the same illustration might depict only an appendage; for purposes of tabulation, two entries were made, with category 1 or 2 coded first, then category 4 on a separate tabulation line

human-like objects - illustrations containing dolls, or other manipulative items were not considered to be human representation, but objects for manipulation; these illustrations, unless human inclusion was obvious, were placed in the nonhuman category (i.e., not categorized)

illustrations - each illustration and/or photograph was counted separately on each page regardless of continuity of theme according to the following guidelines: (a) have a distinct border; (b) be associated with a descriptive or instructional caption (c) include a changed activity or scene; in some instances many figures or objects were clustered on a page under one caption; if these separate figures or objects were not isolated from other objects by a distinct border and/or caption, then the cluster was considered a single illustration

minority - an individual designated as a member of an ethnic group; an individual with physical characteristics that strongly suggest Asian, Black, American Indian, or Hispanic heritage

passive - an individual who is not actively interacting with an object or person; an individual observing an object or another person with no intent of discovery or obtaining pertinent or relevant information; an individual not performing a specific activity

race unidentifiable - an individual in a diagram who, by positioning or omission of body parts, cannot be identified by race

sex unidentifiable - an individual in a diagram who, by positioning or omission of body parts, cannot be identified by sex

small group/participants identifiable - illustrations that present usually 20 or fewer individuals; only those individuals constituting the central theme or focus of the illustration were tabulated (maximum of nine individuals tabulated)

small groups/participants unidentifiable - illustrations that present individuals whose sex and/or race cannot be readily identified due to photographic technique e.g., size of subjects too small, or distance from camera too great creating fuzziness or lack of clarity were included in category 3

A sequential number of steps were undertaken during the evaluation. First, the total number of illustrations in each textbook was tabulated and recorded. Second, each human illustration and/or photograph on each page was evaluated and coded separately. Illustrations found on the cover, in the forward, index, glossary, appendix, and the teacher edition section of a text were not evaluated. The scheme developed and used to code data was called Science Text Evaluation Process (STEP). The scheme permitted recognition of illustrations by series and text and identification of individuals in illustrations by group, race, sex, and as active or passive.

The researchers employed two procedures to ensure interrater reliability. One approach consisted of a simple percent agreement based on the maximum number of times a data column was coded by one observer over the maximum number of times the second observer coded the same column. Eighty percent was considered an acceptable measurement of agreement. The second reliability score obtained was Cohen's Kappa (Cohen, 1960). Cohen's Kappa was deemed acceptable at the 70% level. Acceptable estimates of reliability for each randomly selected textbook were calculated by determining the agreement scores between the observers for each data column. The median for all columns for each textbook was also calculated.

Prior to evaluating any of the current series used in the study it was

necessary to reach the expected 80% and 70% agreement scores using dated elementary science textbooks. In this preliminary study the first observer coded a third grade science text across all columns on the instrument. Every fourth entry on the coding sheets was then selected and reliability estimates were obtained.

To ensure that reliability was maintained at the expected percentages throughout the evaluation of the current series, every fourth textbook was selected for an estimate of reliability. The reliability estimates did not fall below the designated percentage. The median reliability scores for all books combined was .93 for simple agreement and .85 for Cohen's Kappa.

Results

The investigation included evaluation and coding of almost 6,000 human illustrations in seven 1-6 elementary science series. The total number of human illustrations in each series varied from 554 to 1,129. Of the total number of illustrations in all texts, 38.6 percent were coded as human.

[insert Table I & II]

The human illustrations were further categorized to indicate the qualitative dimension of the investigation. Data for the category adult suggest that, on the average, 60% of the individuals represented were males, 35% were females, and 5% of the individuals were unidentifiable. Seventy-seven percent of the adults represented were nonminorities.

[insert Table III]

Adults were shown in a wide variety of science and nonscience related activities and career roles. Although females were represented less frequently in the illustrations, they nevertheless assume roles similar to their male counterparts. They were illustrated as scientists, doctors,

nurses, paramedics, veterinarians, astronauts, meteorologists, marine biologists, foresters, park rangers, florists, construction workers, electricians, and other science and nonscience career roles. They were also shown as mothers, athletes, circus workers, clowns, dancers, and musicians. Females were also shown with greater frequency than males in roles such as sales clerks, teachers, and homemakers, but they were depicted less often than males as farmers, produce managers, and miners. When adult males and females assume occupational roles in the same illustrations, the male typicaly assumes a more prestigious position. When a doctor and nurse are illustrated together the doctor is male and the nurse is female. When pictured alone the female is depicted as a doctor. Rarely do adult minorities and adult nonminorities appear together in the same illustration. Adult minorities are usually shown in roles or activities dealing with parental or familial situations and in such occupational roles as teachers and mechanical workers. They appear less often in science related career roles.

[insert Table IV]

Data for the category child indicate that on the average 50% of the individuals represented were females; four percent of the individuals could not be identified by sex. Sixty-five percent of the children were nonminorities and 4% of the individuals could not be identified by race.

Similar to adults, children are shown in numerous roles, settings, and performing a number activities. Science-related activities involve measuring, observing, recording data, experimenting, constructing and manipulating apparatuses, and interacting with the immediate environment in an effort to discover a principle or unknown phenomenon. Nonscience activities included performing athletic exercises, flying kites, playing on

playgrounds, paticipating in parties, walking, riding bicycles, and participating in parental or familial activities such as picnics, camping expeditions, meals, and discussions around fireplace settings. In addition, children are shown interacting with peers, watching television, listening to others, reading, cooking, and shopping. Although female and male children are depicted in similar situations, some sex-role distortions are present. Boys are shown more frequently in activities such as moving heavy objects, fishing, and playing baseball than are girls. Girls are shown more often in activities such as cheerleading, playing "dress-up", and self-grooming.

[insert Table V]

Sixteen percent of the illustrations were coded as appendage. Of the appendage illustrations, 82% were nonminority and 18% were minority. Appendages were usually an arm and hand manipulating an apparatus for experimental purposes. Other illustrations included close-up photographs of an ear, eye, nose, foot or leg.

As we have identified active and passive (see pp. 11-12), rarely are individuals in the illustrations shown as passive. Seven percent of the males and 7.5 percent of the female individuals in the category adult for all textbooks were identified as passive; an average of 7% of the adult nonminorities and 5% of the minority individuals were categorized as passive; five percent of the male children and 6% of female children were identified as passive; five percent of the nonminority children and 6% of the minority children were coded as passive.

Discussion

This descriptive analysis of the illustrations in elementary science textbooks was conducted to determine whether: (1)individuals of all ages regardless of sex or race are depicted, (2)individuals of all ages regardless of sex or race are depicted as active participants in science activities and (3)adult minority and nonminority males and females are depicted in a variety of roles related to science.

The results must be considered in light of the following limitations. The instrument that was developed to evaluate the illustrations did not differentiate among minority groups. As a result, the representation of specific minority groups was not indicated. Differentiation was made only between a minority or a nonminority individual. Also, no distinction was made as to the degree of activity exhibited by the individuals in the illustrations. Except for a brief description accompanying each coded illustration, an individual was either passive or active as defined. This limitation became apparent when boys were observed performing an activity while girls were noted watching. While these girls were considered active by definition (e.g., observing with intent of gaining information or learning) they were "less active" than their male counterparts. Although high reliability estimates were maintained throughout the analysis, only two observers were involved in the evaluation process. More effective reliability estimates could have been achieved with the use of additional observers. Given these limitations, the data can be interpreted respective to each hypothesis.

Hypothesis 1. If elementary science textbooks display science positively for all societal groups, then the illustrations will depict a variety of individuals as active participants in science activities regardless of sex, race, or age. The data reveal that individuals were

represented in 41% of the total illustrations. In most instances these individuals were depicted as active regardless of the activity. Individuals of both sexes, of various ethnic groups, and of all age groups were included. It can be concluded that elementary textbooks do display science positively for societal groups.

Hypothesis 2. If all students are to favorably associate themselves as participants of science activities or roles, then the science textbooks illustrations will include children in a variety of science activities and settings, regardless of sex or race. The data do indicate that students do have the opportunity to view children in a variety of science activities irrespective of sex or race. Fifty percent of the children represented were females, 46% males, and many were minorities. Most of the children were frequently shown participating in a variety of science activities. However, nonminorities were represented over twice as often as minorities in full-bodied illustrations and represented over four times as often in appendage illustrations. As a result, students perceive minorities participating in science less often than nonminorities.

Hypothesis 3. If career fields in the discipline of science are to be presented to females and minorities, then the illustrations of elementary science textbooks will depict females and minority groups members in a variety of occupational roles related to science. Females were depicted throughout the illustrations in numerous science and nonscience career roles. The science-related career roles include a variety of occupations. However, they were represented in these roles less often than males. Similarly, minorities appear less often in science roles than do nonminorities. This representation of females and minorities in science-related occupational roles limit the opportunities children are able to see

representatives of these two groups in science career fields.

The results also indicate that female children were represented with greater frequency in science and nonscience activities than their male counterparts. This finding contradicts earlier reports indicating that females are underrepresented in science illustrations (Weitzman, 1974; Gallagher, 1980). The data suggests that publishers have made significant progress improving the image of young females in science texts.

Adult and child minorities were portrayed less often than nonminorities. Minority children were depicted in both science and nonscience activities with equal frequency. However, adult minorities were rarely depicted in science-related career roles or activities. The infrequent portrayal of minority adults in careers related to science suggests that although science related career roles are prevalent in society, they are assumed less often by minorities.

Implications and Suggestions

In the introduction of this paper we suggested that science textbooks should depict society as it was, is, and as it should be. It became clear as the investigation was in its early stages that science textbook illustrations highlight concepts that focus on depicting science and society as it is and should be, but that few texts include illustrations that depict historical facets of science and its relationship to society. Hence, it seems fair to suggest that elementary science series do not provide young learners with a broad, comprehensive, and balanced view of science in society.

As we suggested earlier, many science educators seem to support this social action use of science textbooks; that is, depicting society as it is and as it should be. A report submitted by the Pennsylvania Department of

Education (1977), for example, recommends that educational materials used in schools should promote personal worth and dignity and provide for the respect of the abilities and rights of all individuals regardless of racial status and sex. According to the investigators, illustrations and the on-going prose of texts should attempt to portray children and individuals in a variety of settings and roles. Bybee and Kahle (1982) recommend that special attention be given to incorporating content about females into science curricular materials and that attention be given to providing teachers with strategies aimed at overcoming sexist portrayals in science textbooks. Jacobowitz (1983), after studying the achievement and career preferences of black students, recommends that minorities be motivated to participate in those activities that link achievement to careers in science. She argues that such social science activities would help channel more blacks into science careers and also eliminate science as a masculine, nonminority domain. A more recent study cited in Education Week (1984) suggests that involvemet in science activities is essential to encouraging females to pursue careers in science fields. These studies seem to underscore the importance of illustrations in science textbooks of: (1)providing students with role models, (2)enabling students to develop perceptions of themselves in possible societal roles associated with science, (3)giving children the opportunity to view themselves as active participants in science related activities, and (4)providing children with positive self-concepts of themselves in relation to science.

What can be done to influence publishers, science supervisors, curriculum directors, and classroom teachers to adopt a social action science curriculum? There are no definitive answers but the recommendations described below may realize a social action science

education. First, we recommend that publishers continue their efforts at including illustrations that are reflective of America's multiethnic society. However, a greater effort should be expended at representing adult females in a manner that reflects their potential in science-related careers. Persistent patterns of decreasing female representation in the illustrations of upper elementary and secondary texts should be avoided. Children begin to form self-perceptions in relation to potential career aspirations in these elementary grades. Subsequently, young females need to view themselves as often as males in jobs such as engineering and the physical sciences, two areas where women are underrepresented (Kahle, 1982).

Generally, the data indicate that minority group representation in elementary science series is reflective of the group's population in the United States. However, minority adults are underrepresented in illustrations depicting science related career roles. It seems fair to recommend that publishers increase efforts at portraying minorities in a wider variety of potential science related career roles.

In many school locations where minorities are a majority, multicultural materials are essential. According to Grant and Eiden (1982), minority student populations in public schools in New Mexico, Mississippi, Hawaii, and the District of Columbia are 46%, 52%, 75%, and 96%, respectively. While primary texts do portray minority children performing science activities, the majority of the illustratons depict nonminority adults in science-related occupations. For elementary science texts to portray society as it should be, publishers will need to include more illustrations of adult minorities in a variety of science related roles.

The examination of illustrations in elementary science series

suggests that publishers need to improve the depiction of societal groups. The findings suggest that elementary science textbooks limit minority students' perceptions of science and science careers by illustrating the groups less often in these roles than white male adults. While publishers have made improvements in the portrayal of female and minority children, more effort is needed to present science positively to all members of society. In particular, adult females and minorities should be depicted with greater frequency in a variety of occupational ad nonoccupational roles. Such recommended changes would help to reduce stereotypic perceptions of women, minorities, and other societal groups in science and do much to help representatives of these groups perceive of science as a field of endeavor.

Some proponents of social action science have suggested that publishers adhere to specific formulae when depicting minorities and women. According to these educators the number of minorities and women portrayed in the illustrations should reflect their proportional number in society in general and their numbers in the field of science. This would ensure an accurate and objective portrayal of societal groups. Although this approach has merit it falls short of presenting society as it was and should be. Moreover, advocating a "numbers approach" may not be the most reasonable method of convincing publishers that a broad and comprehensive portrayal of minorities and women is worthwhile.

Science supervisors and curriculum directors should continue conducting inservice workshops, seminars, and presentations at science conferences in the area of science textbook evaluation. Supervisors could instruct teachers on effective methods of evaluating their own texts and other curriculum materials. Curriculum directors could show teachers how

to incorporate into science lessons illustrations that depict children and the adult active in science. Curriculum specialists could also outline ways to include all students in science activities, particularly minority and female learners.

Classroom teachers can play an active role in a social action science program by employing textbook illustrations and adopting lessons that involve the students in a variety of activities. For example, in the lower grades the teacher could use role playing and community resources to emphasize career roles in science. In the upper grades, teachers can take advantage of the portrayal of females in science texts and develop science lessons that ask students to involve themselves in activities as they are portrayed. In specific geographic locations where the population includes a larger percentage of minorities than is presented in the textbooks, special efforts should be initiated by the teacher to include discussions of minority individuals in a variety of career roles.

Much progress has been made in science education to ensure that minorities and females are adequately represented in textbooks. In contemporary elementary series children are involved in science, and young learners are able to read and see a variety of individuals participating in science careers. However, additional progress must be made if publishers, science supervisors, curriculum directors, and classroom teachers are to move closer to the goal of enhancing science education for all students.

Summary

Illustrations in seven elementary science textbook series were quantitatively and qualitatively evaluated for portrayal of females and minority groups. An evaluation instrument was developed and implemented in the study. Individuals in the illustrations were evaluated according to

sex, race, child or adult, and degree of activity. The results indicate that female children are represented with greater frequency than male children. Adult females are represented in a variety of science and nonscience career roles but with less frequency than males. Minority adults and children are represented with less frequency than nonminorities. Minority adults are rarely shown in science related roles. It was concluded that while young learners can perceive themselves as active in science activities, the textbooks limit science as a potential career role for minorities by depicting them less often in science related professions.

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TABLE I

Number and Percent of Illustrations in
Selected Elementary Science Textbook Series

Publisher	1	2	3	4	5	6	7
Total No. of Illus. in Series	1633	2454	1608	1003	3372	2951	2416
Total No. of Human Illus. in Series	881	777	651	554	1129	1116	857
Percent of Human Illus.	54	32	40	55	34	38	35

TABLE II

Categories Expressed in Percent in Selected Elementary Science Textbook Series

Publisher	Categories			
	Child	Adult	Aerial	Appendage
1	56	17	4	22
2	50	31	4	14
3	47	29	6	17
4	66	15	5	13
5	59	21	5	14
6	54	24	6	15
7	54	25	6	14
Mean	55	23	5	16

TABLE III

Percent of Adults by Gender and Race in
Selected Elementary Science Textbook Series

Publisher	Gender			Race		
	Male	Female	Unidentified	Minority	Nonminority	Unidentified
1	57	36	7	20	69	11
2	62	33	5	12	86	2
3	60	37	3	22	76	2
4	59	33	8	13	76	11
5	61	34	5	16	79	5
6	59	35	6	16	79	5
7	59	39	2	21	76	3
Mean	60	35	5	17	77	6

TABLE IV

Percent of Children By Gender and Race in Selected Elementary Science Textbook Series

Publisher	Gender			Race		
	Male	Female	Unidentified	Minority	Nonminority	Unidentified
1	49	48	3	37	59	4
2	46	51	3	33	65	2
3	50	49	1	31	66	3
4	45	48	7	24	71	5
5	43	51	6	31	63	6
6	42	54	4	27	71	2
7	47	49	4	35	61	4
Mean	46	50	4	31	65	4

TABLE V

Percent of Appendage Illustrations by Race

in Selected Elementary Science Textbooks Series

Race	Publisher							Mean
	1	2	3	4	5	6	7	
Minority	32	22	15	9	17	14	17	18
Nonminority	68	78	85	91	83	86	83	82